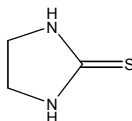


ETHYLENE THIOUREA

CAS No. 96-45-7

First Listed in the *Fourth Annual Report on Carcinogens*



CARCINOGENICITY

Ethylene thiourea is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals. When administered in the diet, ethylene thiourea induced thyroid follicular cell carcinomas in rats of both sexes. When administered by gavage, ethylene thiourea induced hepatomas in mice of both sexes (IARC V.7, 1974; IARC S.4, 1982; IARC S.7, 1987).

There is inadequate evidence for the carcinogenicity of ethylene thiourea in humans. One study of workers exposed at some time to the compound in rubber manufacturing companies reported no case of thyroid cancer. Statistically, however, less than one case of cancer would have been expected in the group (IARC S.4, 1982; IARC S.7, 1987).

PROPERTIES

Ethylene thiourea occurs as white-to-pale-green needle-like crystals with a faint amine odor. It is very soluble in hot water; slightly soluble in cold water, methanol, ethanol, ethylene glycol, pyridine, acetic acid, and naphtha; and insoluble in acetone, ether, chloroform, and benzene. When heated to decomposition, ethylene thiourea emits toxic fumes of nitrogen oxides (NO_x) and sulfur oxides (SO_x). Ethylene thiourea is available in the United States as crystals, as a powder, as an 80% dispersion of the powder in oil, or encapsulated in a matrix of compatible elastomers.

USE

Ethylene thiourea is used primarily as an accelerator for vulcanizing polychloroprene (neoprene) and polyacrylate rubbers. Neoprene rubbers are used almost exclusively in industrial applications (e.g., for mechanical and automotive products), in wire and cable production, in construction, and in adhesives. Polyacrylate rubbers are used in products such as seals, o-rings, and gaskets for automotive and aircraft applications. Ethylene thiourea is used in the manufacture of ethylenebisdithiocarbamate pesticides, such as amobam, maneb, mancozeb, metiram, nabam, and zineb. Ethylene thiourea is also used in electroplating baths, as an intermediate in antioxidant production, in dyes, pharmaceuticals, and synthetic resins (IARC V.7, 1974; Sax, 1987).

PRODUCTION

There are no current production volumes available for ethylene thiourea. Furthermore, no producers are identified (SR1a, 1997). The 1998 Chemical Buyers Directory, however, lists two domestic suppliers of the compound (Tilton, 1997). There are also no recent data on imports or exports; however, the United States exported approximately 13.8 million lb of rubber-processing accelerators, activators, and vulcanizing agents in 1985, and more than 18.3 million lb in 1984 (USDOC Exports, 1985; USDOC Exports, 1986). In 1985, the United States imported nearly 10.6 million lb of products used chiefly as rubber-processing chemicals, and in 1984, over 925,000 lb were imported (USDOC Imports, 1985; USDOC Imports, 1986). Production of ethylene thiourea was last reported to the USITC in 1980, when a single company had an implied production of > 1,000 lb (USITC, 1981). The 1979 TSCA Inventory identified two companies producing 550,000 lb of ethylene thiourea in 1977 and five companies importing 110,000 lb. The CBI Aggregate was between 1 million and 100 million lb (TSCA, 1979). Commercial production of ethylene thiourea was first reported in the United States in 1951 (IARC V.7, 1974).

EXPOSURE

The primary routes of potential human exposure to ethylene thiourea are inhalation, ingestion, and dermal contact. The risk of potential occupational exposure to the compound is greatest for workers involved in the manufacture of rubber and rubber products. The National Occupational Exposure Survey (1981-1983) indicated that 7,403 total workers, including 1,363 women, potentially were exposed to ethylene thiourea in the work place (NIOSH, 1984). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 3,500 workers were potentially exposed to ethylene thiourea during the manufacture of rubber products (NIOSH, 1976). Since the commercial product used to vulcanize rubber is in an elastomer matrix, the potential for the formation of fine dust dispersions in the workplace air is small (NIOSH 22, 1978). However, although the curing of rubber converts all of the ethylene thiourea to other compounds, traces are still present in the cured products. The results of a test on a specific neoprene stock indicated that 0.01 mg unchanged ethylene thiourea/inch² of surface could be extracted by water at 57 °C over a period of 7 days. Consumer products containing neoprene include shoes and closures for containers (e.g., aerosol dispensers) (IARC V.7, 1974).

Potential occupational exposure also occurs during the manufacture, formulation, and application of fungicides and insecticides produced from ethylene thiourea. Residues of the compound have been found in 28 different commercial ethylenebisdithiocarbamate products. Treatment of kale and lettuce with maneb at a rate of 1.09 kg active ingredient/acre resulted in initial residues of 0.6 mg/kg ethylene thiourea, which decreased to undetectable levels within 7 days after application. Concentrations of ethylene thiourea from 0.018 to 0.044 mg/kg have been detected on apples sold for human consumption (IARC V.7, 1974). Ethylene thiourea can also be formed when food containing the pesticides is cooked (NIOSH 22, 1978).

The Toxic Chemical Release Inventory (EPA) estimated that 268 lb of ethylene thiourea were released to the environment, specifically to air, from four facilities that produced, processed, or used the chemical in the United States in 1996. One facility located in Mossville, Illinois, reporting under the industrial classifications for manufacture of fabricated rubber products (SIC Code 3069), plastics products (3089), rubber and plastic hose and belting (3052), and mechanical rubber goods (3061), accounted for 93.3% of the total air emissions (TRI96, 1998).

REGULATIONS

In 1980 CPSC preliminarily determined that ethylene thiourea was not present in consumer products under its jurisdiction. Subsequently, public comment was solicited to verify the accuracy of this information; no comments were received. Pending receipt of new information, CPSC plans no action on this chemical. EPA regulates ethylene thiourea under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Food, Drug, and Cosmetic Act (FD&CA), Resource Conservation and Recovery Act (RCRA), and Superfund Amendments and Reauthorization Act (SARA). A reportable quantity (RQ) of 10 lb has been established for the compound under CERCLA. A rebuttable presumption against registration (RPAR) and continued registration of ethylenebisdithiocarbamate pesticide products, which may contain ethylene thiourea residues, has been initiated. It is regulated as an inert ingredient of pesticide formulations under FD&CA. Releases of ethylene thiourea are regulated under RCRA and SARA. FDA prohibits the use of ethylene thiourea as a food additive. NIOSH has recommended that the encapsulated form of the compound should be used by industry and that exposure in the workplace be reduced to the lowest feasible concentration. OSHA regulates ethylene thiourea under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-63.